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Forage production and bromatological composition of *Gliricidia sepium* (Jacq) Kunth ex Walp

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Abstract

Forage production and bromatologic composition of *Gliricidia sepium* (Jacq) Kunth ex Walp were evaluated on cattle raising serpentine soils from the Livestock Center *Noel Fernández* in Camagüey, Cuba. Data were processed by the statistical package SPSS, and mean and standard deviation were determined. *G. sepium* foliage levels were significant (3,68 kg/a/cut for green matter and 1,33 kg/a/cut for dry matter) and raw protein levels were satisfactory (13,2 %).

Key Words: Gliricidia sepium, *living fences, foliage, bromatology*

Introduction

The use of trees in cattle raising is a thousand-year-old practice with numerous effects on the ecosystem: they ease climatic effects (rainfall, sun radiation and evaporation) and provide food and comfort to livestock (Simón, 1998 and Guillot *et al.*, 2005). It is mainly used in traditional extensive cattle raising in which animals get their food from natural forests; thus preserving arborescent and shrub-like species. They help preserve the soil from deposition by erosion and landslides. As a result, the environment is protected and vegetation is balanced (Hernández, 2002; Valenciaga and Mora, 2002; Acosta *et al*., 2005 a, b).

Jordan (2001), and Funes and Monzote (2003) highlighted the importance of diversification of trees to recover the natural habitats of wild species of animals.

In Cuba, as in other parts of the Americas, reintroducing trees and bushes in pasture lands is a significant alternative to restore soil fertility (Simón, 2000; Ruiz and Febles, 2001; Acosta *et al*., 2006; Ibrahim *et al*., 2006 and Crespo, 2008). Considering their potential benefits, the use of live fences can be a viable alternative for cattle raising, from the productive and environmental perspectives.

After *Leucaena leucocephala* (Lam) of Wit, *G. sepium* is probably the most widely used multipurpose tree. It was initially used to provide cacao and other crops with shade. It is currently integrated to other practices and uses, such as wood, live fences, animal feed, green fertilizers and soil stabilizer (Suárez, Simón and Yepes, 1996).

The aim of this paper is to assess forage production and bromatological composition of *Gliricidia sepium* (Jacq) Kunth ex Walp in edapho-climatic conditions at Noel Fernandez State Farm in the province of Camagüey.

Materials and Methods

This study was conducted for two years (November 2010-Nov 2012) in areas of *Noel Fernandez* State Farm of the municipality of Minas (21º28’50”-21º29’15” north latitude; 77º39’50”-77º40’20” west longitude, 40 meters above the sea level) in Camagüey, Cuba. Pine kernel trees —*Gliricidia sepium* (Jacq) Kunth ex Walp— already established in a perimeter fence of about 15 years of age, planted at a distance of 1 meter from each other, were used.

According to Hernández *et al*. (1999), the experiment was conducted on red brown ferromagnesial fersialitic soil. These soils are internationally classified as Inceptisol according to Soil Taxonomy (1994) and Cambisol according to FAO-UNESCO (1990), quoted by Hernández *et al.* (1999a). The climate in the area is that of inner humid tropical plains, with seanonal moisturizing and high evaporation (Díaz, 1989); the air temperature is also high, with mean values between 23 and 24 °C. Mean rainfall ranged between 245.1 and 1 424.5 mm in the low-rain season (PPLL) and the rainy season (PLL), respectively, according to the data supplied by the weather station at the Hidraulica Cubana Dam, pluviometer 835 located at 21º31'50" north latitude and 77º41'30" west longitude.

Foliage yielding

According to Gálvez (1998), the foliage from twenty trees was taken at random ninety days after re-shoot, before November flowering, when the trees were completely trimmed. Three samples of foliage were dried at 65 ºC in a stove with air flow, to achieve constant weight. Then the foliage was analyzed.

The leaf-petioles were removed from the stems and were weighed separately to calculate the percent of the leaf-petiole fresh weight. Yields were calculated with the data from the dry matter.

Bromatological composition

Along with the availability sampling, compound foliage samples (300 g) were studied to determine the contents of dry matter, calcium, phosphorous and gross protein. The analyses were carried out at the Provincial Delegation of Soil Management, from MINAGRI (Ministry of Agriculture), by AOAC (1995).

Statistical analysis

Mean and standard deviation were determined for foliage yielding and bromatological composition, using SPSS, version 15.0.1 (2006).

RESULTS AND DISCUSSION

Foliage yielding

According to the results from cutting every 90 days, the species yields around 3.68 kg/cut of live matter, and 1.33 ± 0.004 kg/cut of dry matter. Considering that it has 36.2 % of dry matter, these results at the farm level might account for values of 13.3 ± 0.003 t/ha/cut of dry matter, assuming plantation settings of 1 x 1 m or 1 t/km of fence, if the existing settings are 1 m between trees. These values could quadruple annually if 53 t/ha/year of dry matter were achieved.

The results accomplished in this scenario are higher than Gálvez (1998), and Pedraza and Gálvez (2000) for *G. sepium* in Camaguey, where a tree was supposed to produce around 2.5 kg/cut and 10 kg/year of live matter in each of four cuts every 90 days.

These values are way above Gómez (1994) for *G. sepium*, who reported green forage productions between 55.5 and 80.6 t/ha, compared to 147 t/ha/year of live matter in this study. The current results are also better than Toscano (2012), for *B. simaruba* in the same area and time of study.

G. sepium is probably the most widely spread multipurpose tree cultivated in the tropics after *Leucaena leucocephala*. Pedraza and Gálvez (2000) in Cuba have shown the forage potential of their live fences. Edible biomass production have accounted for 4.4 kg of live matter per tree 120 days after re-shoot, when strategic trimming was carried out. Digestibility may reach 58 to 69 % (Arcos, 2000 and Pedraza *et al*., 2003).

The usefulness of these results are corroborated by Pedraza *et al.* (2005) who reported that 1 km of live fences of *G. sepium* with a tree separation of 1.5 m may provide yearly nutrients for 20 cows lactating for 240 days, consuming low-quality pasture and mineral supplementation, and producing 1 kg/day of milk, provided water and pasture weren´t limited.

In the case of live fences of five-year planted *Erythrina sp*., the annual yields were over 2 t/km of dry matter, with 22.5 % of gross protein y 53.3 % digestibility. Live fence foliage may bring positive side effects to the farm ecosystem and economy.

Benavides (1993) reports that foliage from different tree and shrub species may help increase the quality of traditional animal diets in developing countries. In Nepal and India, the efficacy of this nutritional alternative has been well accepted (Russo and Botero, 1996).

Bromatological composition

Table 1 shows the bromatological composition of *G. sepium*. It has 13.2 % of gross protein, way higher than the protein contents of graminaceae. This increases the value of the species in the area, also because the levels of P, K, Ca y Mg are higher than in the native graminaceae. This has a positive effect on digestibility of the cattle diet.

These results are slightly higher than Pedraza (2000) for P and Mg, with values of 0.14 and 0.47 %; respectively, and lower for Ca (1.50) and K (1.58).

Benavides (1993) reported protein tenors between 11 and 42 % for 35 tree species, out of which, 20 had more than 60 % dry matter *in vitro* digestibility.

Cáceres, González and Delgado (1994) determined that *L. leucocephala* had protein contents between 15 and 30 %; gross fiber contents between 15 and 25 %; and EM contents of 2-2.4 Mcal/kg of dry matter.

Hernández and Hernández (2005) indicated that *G. sepium* foliage is quickly decomposed and has high nutrient contents. It is estimated to provide 40 kg of N/ha, though plantation on side roads may produce between 60 and 200 kg N/ha/year.

Studies of other legume species, like *A. lebbeck,* concluded that it produces high-nutrient foliage. Cáceres *et al.* (1992) found gross protein values of 30 % for green foliage (18.6 to 26.8 % for pods with seeds). Foliage digestibility is high: 60.1; 61.7; 85.3 and 45.4 % for dry matter, organic matter, gross protein and gross fiber, respectively. This species is within the best and widely known tree forage legumes. Though high consumption may cause toxicity in some single-stomach species, it is an important source of nutrients for ruminants, especially in the dry season (Simón, 1996).

Other nutritional studies in shrub-like legumes have reported on the effects of re-shoot age on their chemical composition. Pedraza (2000) working on *G. sepium* found alterations in foliage nutrient contents at different re-shoot ages. Indicators like gross protein, calcium and ashes tend to decrease with re-shoot age, whereas dry matter, gross fiber and calcium values are increased. A similar behavior was found by Ku Vera *et al*. (2000).

Pedraza (2000) in the same species found levels of dry matter ranging between 19.56 % 60 days after re-shoot, and 37.66 %, 180 days after re-shoot. The protein levels were also found to have ranging levels between 14.7 and 20.4 %, way above the results in this study.

The high nutritional value of these plants allows them to play an important role in the nutrition of several animal species, especially ruminants. They can take full advantage of the protein available in the foliage, along with the energy provided by fiber (Delgado *et al*., 2007). Likewise, the nutritional quality of graminaceae pasture lands is remarkably improved when they are combined with legumes, and it is an economically viable alternative for cattle raising in tropical areas (Espinosa, 2000; Castillo *et al*., 2003; Espinosa, 2004; Maya *et al*., 2005; Cino *et al.,* 2006 and Díaz *et al*., 2008).

CONCLUSIONS

Gliricidia sepium produces significant quantities of foliage and appropriate levels of gross protein and other minerals, like P. Its high nutritional value makes it an important species for the nutrition of several animal species, especially ruminants.

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Table 1. Bromatological composition of *G. sepium* in terms of dry matter percents (Mean ± ES)

Species	Nutrients					
	DM	GP	P	K	Ca	Mg
G. sepium	36.2 ± 1.79	13.2 ± 0.14	0.17 + 0.004	0.6 ± 0.033	1.11 ± 0.002	0.53 ± 0.035
Graminaceae	31.1 ± 0.29	4.5 ± 0.07	0.12 ± 0.044	0.3 ± 0.009	0.4 ± 0.016	0.4 ± 0.006